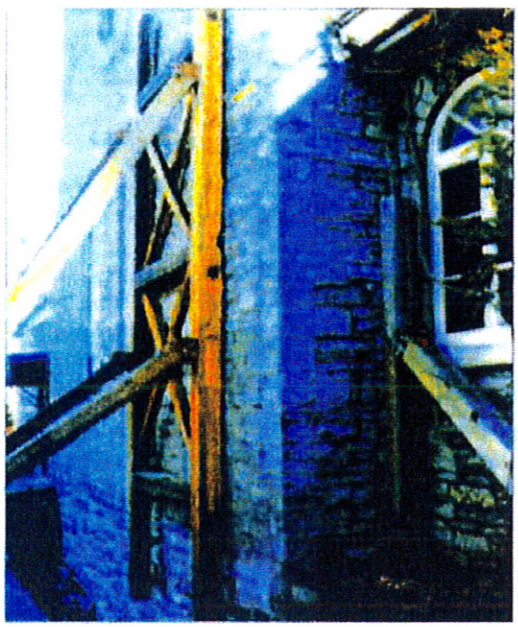
CASE HISTORY

DON'T TEAR IT DOWN... ANCHOR IT DOWN!

ST. ANNE CHURCH, OTTAWA, ON, CANADA

Anrep Associates Ltd, designed and supervised the repair of both transept walls of this Church using CINTEC wall tie anchors and stitching anchors, during the summer of 1991. This Church was built in 1867, and is designated a historic building by the City of Ottawa. This required that the repair work must restore the structure to its original state. Both transept walls consisted of an exterior and interior wythe of limestone masonry of varying thickness, with an interior core of rubble and mortar. The overall wall thickness was 26" (650mm). Over time the mortar in the joints and interior core deteriorated and turned to sand due to weathering, moisture penetration and frost action. When this occurred the rubble and loose sand slowly worked their way down the wall core due to gravity and vibrations. This resulted in a wedge forming in the core, driving the two outer wythes apart. Eventually, the Interior and exterior wythes would no longer act together as a load carrying unit and failure would occur. At one corner a serious bulge had already occurred in the exterior wythe, and vertical cracks on each side of the corner indicated that this portion of wall was separating from the adjacent wall.

The repair required anchoring the two wythes of limestone masonry together using 22" (550mm) long CINTEC wall ties spaced at 3 ft (900mm) on centre horizontal and 1' 6" (450mm) on centre vertical. The inner wall core was then pressure grouted to fill any voids and the existing mortar joints in the exterior wythe wore removed to a depth of 2" (50mm) and replaced. In addition at the corner of the transept wall where the bulge occurred, the exterior wythe of masonry was stitched using CINTEC stitching anchors, installed in holes drilled parallel to the exterior wall face in two directions at 12" (300mm) on centre, staggered. These anchors were 10 ft (3M) long In one direction and 4 ft (1.2M) long In the other direction.



CINTEC anchors were chosen on this project because of their adaptability to be designed for the specific project and the compatibility of the anchoring system with the parent wall material. The stress between the interface of the anchor and the parent material is low due to the large area of the interface. This makes the anchor ideal for use in old/historic buildings, were the strength of the patent material is generally low.

Telephone Americas +1 613 225 3381 USA 1 800 363 6066

Europe +44 (0) 1633 246614 E mail solutions@cintec.com

http://www.cintec.com/cintec/case-studies.php

CINTEC WORLDWIDE

Masonry Wall Conservation

SAINTE-ANNE D'OTTAWA CHURCH, BUILT IN 1873

by John G. Cooke, Engineer

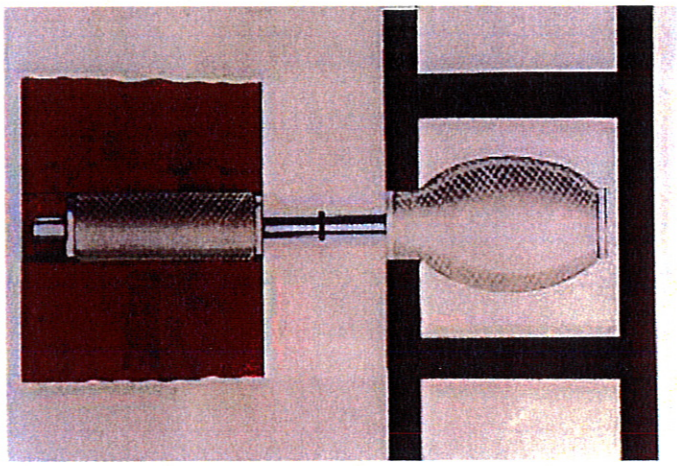


PHOTO: CINTEC RAC FIXINGS FOR BRICK CAVITY WALL

THE CHURCH OF SAINTE-ANNE d'Ottawa was built in 1873 on Old St. Patrick Street. In the fall of 1893, the church was extended by the addition of the transept wings and the reconstruction of the sanctuary. The new church was inaugurated on February 25,1894. In 1967, major renovations to the church were carried out. These repairs included repairs to the main roof trusses, the replacement of the timber floor in the church with a reinforced concrete slab and the addition of a basement below the sanctuary, including a mechanical room. The building was designated a heritage property in 1978 by the City of Ottawa, in accordance with provincial heritage legislation.

EXISTING CONDITION

In the fall of 1990, Anrep Associates Ltd. were employed by the parish of Sainte-Anne d'Ottawa to investigate the cause of a serious bulge on the exterior face of the west transept wall. Upon investigation of the wall it was discovered that, on the inside face of the wall at the location of the bulge, there was a recess in the wall measuring 6' X 7' x 14' dp. approximately. Additional investigation revealed the same recess at the opposite end of the west transept wail and two similar recesses on the east transept wall. In one of the recesses in the east transept wall, part of the timber lintel over the opening had deteriorated due to moisture and failed. This resulted in a large amount of the rubble, between the interior and exterior stone wythes, falling into the recess.

The walls themselves consisted of two wythes of stone, with rubble and mortar in the centre. The walls were about 26" thick. Over time, the mortar in the centre had been

reduced to sand. With constant weathering, freeze thaw cycles due to moisture penetration into the walls, and vibrations, the loose rubble worked its way down the wall, slowly acting like a wedge to pry the two stone wythes apart. This action eventually leads to the wall no longer acting as a single unit, but has two separate wythes acting independently. This results in a substantial weakening of the wall and eventual failure. It was our conclusion that this, in combination with the weakening effect of the recess, was the cause of the bulge. We recommended that the client shore the wall immediately until remedial work would be carried out. In addition, we were also concerned that the potential was high for the same condition to occur on the east wall.

SOLUTION

In consultation with the client, it was agreed that we would not try to remove the bulge in the west transept wall as the cost to shore and stabilize the wall above, while rebuilding the lower section of wall, would be excessive. In addition, in order to strengthen the transepts it was agreed that the interior recesses be built up in order to increase the wall capacities at the location of the recesses. These recesses were covered by the drywall finish on the interior face of the walls, so were not exposed. Structurally, our concern was that due to window placement in the wall, most of the wall self weight was transmitted to the foundations by way of the wall at the location of each recess.

We proposed to repair the walls as follows in order to restore their structural and historical integrity.

1. Rebuild the four recesses (two in each transept wall) using a similar limestone, with a lime base mortar.
2. Anchor the two wythes of stone together using a CINTEC anchoring system.
3. Pressure grout the voids in the wall using a cementitious grout.
4. Rake out the existing joint mortar to a depth of approximately 55mm and repoint the wall using a Lime, White Non-Staining Portland Cement, sand mortar mix. At the client's request, the joints were retooled to match the profile of the mortar joints on the remainder of the structure.
5. At the corner where the bulge existed, the exterior wythe of masonry was stitched using CINTEC stitching anchors. The anchors were installed in holes drilled parallel to the exterior wall face in two directions, staggered, and spaced at 300mm on centre. These anchors were 3000mm long in one direction and 1200mm long in the other direction.
6. Below grade, where the mortar in the joints had deteriorated to sand, the joints were regrouted as above grade, the face of the stone was parged, and a protective coating of a waterproof material was applied to the face of the parging.

ANCHORING SYSTEM

The CINTEC anchors, noted above, originated in England and provided a much better anchoring system than expansion anchors, for the conditions in question. The anchors consisted of a hollow structural steel section which is surrounded by a fabric sock. Grout is pumped into the tube and extrudes through a hole at the inner end of the steel section and fills the fabric sock from the inside out. When the moisture in the grout mix seeps through the fabric on the exterior hole face, the installer knows that the fabric sock has filled the void, and the desired pressure has been achieved. This

moisture also seeps into the surrounding parent material and forms a cementitious bond.

The CINTEC anchors were chosen on this project because of their adaptability to be designed for the specific project and the compatibility of the anchoring system with the parent wall material. The stress between the interface of the anchor and the parent material is low due to the large area of the interface. This makes the anchor ideal for use in old/heritage type buildings, where the strength of the parent material is generally low. The lower the strength of the parent material, the larger the diameter of the hole drilled in the wail and the larger the diameter of the fabric sock.

The typical wail anchors noted in item #2 above were 55mm long. They were spaced at 900mm on centre horizontally and 450mm on center vertically. The outer end of the anchors were recessed 25mm from the face of the wall and covered with the lime based mortar.

SUMMARY

Anrep Associates Ltd. worked closely with the client, with representatives of the Heritage department of the City of Ottawa, with the general contractor, Lariviere Construction Ltee. from Hull, Quebec, and with CINTEC representatives from England, to successfully stabilize and restore the condition of the transept walls, while matching the wall finish with the remaining walls of the church. Though the mortar joint was brighter than that of the mortar on the other walls, it was felt that the brightness would fade over time due to weathering of the mortar joint. The restoration permits the transept walls to perform in the manner they were intended and thus prolong the life of the structure.

Engineer: Anrep & Associates Ltd
Now: John G. Cook & Associates
1750 Courtwood Crescent, Suite 101
Ottawa, ON K2C 2B5
Tel: (613) 226-8718

Masonry Contractor: Larivière Construction Ltée
640 Auguste Mondoux
Gatineau, QC
J9J 3K3
Tel : (819) 770-9703